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(WO/2004/008259) MECHANICAL OSCILLATOR SYSTEM

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Claims 1. A mechanical oscillator system for a horological mechanism or other precision ins comprising a non-magnetic ceramic balance and a non- magnetic balance spring of flat spir balance spring being formed of a composite material or a polymer, carbon or ceramic mater

2. A system according to claim 1 wherein said balance spring material comprises continuou the length of the balance spring from one end of said spring to the other end of said spring.

3. A system according to claim 1 or 2 wherein the balance spring is of a composite material comprises polymer, carbon or ceramic.

4. A system according to any one of the preceding claims wherein the coefficient of thermal and the coefficient of thermal expansion of the material of the balance spring in the direction balance spring are of opposite signs and of similar orders of magnitude so as to compensat the system.

5. A system according to claim 4 wherein the coefficient of thermal expansion of the balance coefficient of thermal expansion of the material of the balance spring in the direction along t spring is negative.

6. A system according to claim 5 wherein the thermal coefficient of expansion of the balance coefficient of thermal expansion of the material of the balance spring in the direction along t spring is greater

7. A system according to any one of claims 2 to 6 wherein said continuous fibres are carbon

8. A system according to claim 7 wherein said fibres have a graphitic carbon structure.

9. A system according to any one of claims 2 to 8 wherein the fibres are produced from one polyacrilonitrile'PAN'.

10. A system according to any one of claims 1 to 9 wherein the balance spring is of a compc coefficient of thermal expansion in the direction along the length of the balance spring, said expansion being linear and negative up to Kelvin.

11. A system according to any one of the preceding claims wherein the damping of the mod balance spring is of the order of 0.001 Pa.

12. A system according to any one of claims 1 to 4 wherein said balance spring material cor

13. A system according to claim 12 wherein said ceramic fibres have coefficient of thermal e than

14. A system according to any one of claims 2 to 13 wherein said fibres are substantially pa

14. A system according to any one of claims 2 to 13 wherein said fibres are substantially pa

15. A system according to any one of claims 2 to 13 wherein said fibres are twisted together

16. A system according to any of the preceding claims wherein the balance spring is a flexic work in flexion to oscillate the balance.

17. A system according to any one of the preceding claims the density of the balance spring

18. A system according to any one of the preceding claims wherein the balance is formed b moulding.

19. A system according to any one of the preceding claims wherein the material of the balar thermoelastic coefficient.

20. A mechanical oscillator system for use in a horological movement or other precision inst comprising a balance and a balance spring of spiral or helicoidal form, the balance being of balance spring of a composite material.

21. A system according to claim 20, wherein the composite material comprises continuous c parallel in the sense of the main axis of the fibre according to the stiffness required.

22. A system according to claim 21, wherein according to the modulus of elasticity required, from one of the precursors"PITCH"or polyacrilonitrioe"PAN".

23. A system according to claim 21 or 22, wherein the fibres are coated in a matrix phase of thermoplastic polymer or ceramic.

24. A system according to any one of claims 20 to 23, wherein the balance spring material is effects of magnetisation.

25. A system according to claim 21, wherein the fibres have a graphitic carbon structure and expansion in the axial sense is negative.

26. A system according to any one of claims 20 to 25, wherein the coefficient of thermal exp spring is linear and negative up to

27. A system according to any one of claims 20 to 26, wherein the damping of the elastic m spring is of the order of 0.001 Pa.

28. A system according to any one of claims 20 to 27, wherein the balance spring has a den

29. A system according to any one of claims 20 to 29, wherein the balance spring is in a spi exclusively in flexion.

30. A system according to claim 20, wherein the ceramic material of the balance is selected thermal variations in the system.

31. A system according to claim 20, wherein the balance is fabricated by a method of high p moulding.

32. A system according to claims 20 to 31, wherein the coefficient of thermal expansion of th order to compensate the balance spring which has a negative coefficient of thermal expansi

33. A system according to any one claims 20 to 32, wherein the balance is not sensitive to th magnetisation.